

CLAIMS**What is claimed is:**

- 1 1. A transcatheter microwave antenna, comprising:  
2 a microwave transmission line having first and second opposing ends, said first  
3 end being adapted for connection to a microwave power source, said microwave  
4 transmission line having a center conductor and an outer conductor;  
5 a microwave antenna disposed on said second end of said microwave antenna;  
6 a layer of fusion material disposed radially outward of said microwave antenna,  
7 said fusion material being alterable from a first physical state to a second physical state to  
8 provide heat of fusion cooling adjacent said catheter during operation of said microwave  
9 antenna.
- 1 2. The transcatheter microwave antenna of Claim 1, wherein said fusion material is  
2 operable for being in a solid physical state prior to operation of said microwave antenna  
3 and is operable for melting to a liquid state during operation of said microwave antenna  
4 so as to provide cooling radially outward from said catheter.
- 1 3. The transcatheter microwave antenna of Claim2, wherein said fusion material in  
2 said solid state is substantially flexible.

1 4. The transcatheter microwave antenna of Claim 1, wherein said fusion material is  
2 substantially transparent to microwave radiation so as to absorb little energy directly from  
3 said microwave radiation.

1 5. The transcatheter microwave antenna of Claim 1, wherein said fusion material has  
2 a melting point in the range of from approximately eighty to one hundred degrees  
3 Fahrenheit.

1 6. The transcatheter microwave antenna of Claim 1, further comprising:  
2 electrical insulating material between said center conductor and said outer  
3 conductor, said microwave antenna being disposed within said electrical insulating  
4 material.

1 7. The transcatheter microwave antenna of Claim 1, further comprising:  
2 an outer sheath surrounding said fusion material.

1 8. The transcatheter microwave antenna of Claim 1, wherein said layer of fusion  
2 material is in surrounding relationship with said microwave antenna.

1 9. The transcatheter microwave antenna of Claim 1, wherein said fusion material is  
2 comprised of a crystalline material.

3 10. The transcatheter microwave antenna of Claim 1, wherein said fusion material is  
4 comprised of a powdered material.

1 11. The transcatheter microwave antenna of Claim 1, wherein said fusion material is  
2 comprised of dibasic sodium phosphate.

1 12. The transcatheter microwave antenna of Claim 1, wherein said fusion material is  
2 comprised of phosphonium chloride.

1 13. The transcatheter microwave antenna of Claim 1, further comprising:  
2 a tubular conductor to act as an attenuator of microwaves, said tubular conductor  
3 being mounted at or near a surface of said catheter and being axially positioned on said  
4 catheter adjacent said microwave antenna.

1 14. The transcatheter microwave antenna of Claim 1, further comprising:  
2 providing material for absorbing microwave heat energy on one side of said  
3 microwave antenna so as to make said microwave antenna directional.

1 15. A method of constructing a transcatheter microwave antenna, further comprising:  
2 providing a cable with one or more conductors;  
3 adapting said cable for connection to a microwave power source;  
4 providing a microwave antenna at one end of said cable;  
5 providing a layer of fusion material adjacent said microwave antenna, said fusion  
6 material being alterable to a second physical state from said first physical state to provide  
7 heat of fusion cooling adjacent said catheter during operation of said microwave antenna.

1 16. The method of Claim 14, further comprising:  
2 selecting said fusion material to have a melting temperature in the range from  
3 about eighty to one hundred degrees Fahrenheit.

1 17. The method of Claim 14, further comprising:  
2 selecting said fusion material to be sufficiently flexible for use with a catheter.

1 18. The method of Claim 14, further comprising:  
2 providing that said fusion material is in surrounding relationship to said  
3 microwave antenna.

MSC-23049-1

1 19. The method of Claim 14, further comprising:

2 providing that said microwave antenna is directional.

1 20. The method of Claim 14, further comprising:

2 providing that said fusion material is a powdered substance when in said first  
3 physical state.

1 21. The method of Claim 14, further comprising:

2 providing that said fusion material is a crystalline substance when in said first  
3 physical state.

1 22. A method for selective thermal ablation of a tissue to be treated while limiting  
2 thermal damage to a protected tissue, comprising:

3 positioning an energy radiator adjacent to said tissue to be treated such that said  
4 protected tissue is between said tissue to be treated and said energy radiator;

5 positioning a layer of fusion material between said energy radiator and said  
6 protected tissue such that convection transfer of energy may occur between said protected  
7 tissue and said layer of fusion material;

8 radiating energy from said energy radiator to heat said tissue to be treated;

9 limiting temperature rise in said protected tissue by convection transfer of energy

10 between said protected tissue and said fusion material; and  
11 limiting temperature rise in said fusion material by melting said fusion material  
12 from a first physical state to a second physical state due to said convection transfer of  
13 energy between said protected tissue and said fusion material.

1 23. The method of Claim 22, wherein said fusion material has a melting point below  
2 body temperature.

1 24. The method of Claim 22, wherein said fusion material has a melting point in the  
2 range of about ninety to one hundred degrees Fahrenheit.

1 25. The method of Claim 22, wherein said fusion material has a melting point at body  
2 temperature.

1 26. The method of Claim 22, further comprising:  
2 controlling said energy radiator so as to direct energy from said energy radiator in  
3 one or more selected directions toward said tissue to be treated.

1 27. The method of Claim 26, further comprising:  
2 positioning energy absorbing material adjacent said energy radiator to absorb

MSC-23049-1

3 energy from energy radiator other than energy directed in said one or more selected  
4 directions.

1 28. The method of Claim 22, wherein said fusion material is microwave transparent  
2 to limit energy transfer directly from microwaves into said fusion material.

1 29. The method of Claim 22, further comprising:  
2 selecting a frequency of operation based on a distance of said energy radiator to  
3 said tissue to be treated.

1 30. A method for selective thermal ablation of a tissue to be treated while limiting  
2 thermal damage to a protected tissue, comprising:  
3 positioning fusion material adjacent said protected tissue to permit convection  
4 transfer of energy between said fusion material and said protected tissue, said fusion  
5 material having a melting point near to or lower than body temperature;  
6 radiating energy through said fusion material;  
7 radiating energy through said protected tissue; and  
8 radiating energy into said tissue to be treated.

1 31. The method of Claim 30, further comprising:





2 using a microwave antenna with radiation points adjusted for depositing energy at  
3 a determined distance of said tissue to be treated from said microwave antenna.

1 38. The method of Claim 30, further comprising:  
2 selecting frequency of operation for depositing energy at a determined distance of  
3 said tissue to be treated from said microwave antenna.

1 39. The method of Claim 30, further comprising:  
2 selectively directing energy from a microwave antenna in one or more directions  
3 to deposit energy in said tissue to be treated.

1 40. A computer program for controlling a simulated microwave antenna for simulated  
2 radiation of a biological tissue, comprising:  
3 providing at least one antenna characteristic for said simulated microwave  
4 antenna;  
5 providing at least one tissue characteristic into which microwave energy is  
6 deposited; and  
7 providing at least one cooling characteristic of cooling substances through which  
8 microwaves are transmitted.

- 1 41. The computer program of Claim 40, further comprising:  
2 providing a frequency of operation.
- 1 42. The computer program of Claim 40, further comprising:  
2 providing a power level.
- 1 43. The computer program of Claim 40, further comprising:  
2 providing a delivery time of microwave energy.
- 1 44. The computer program of Claim 40, further comprising:  
2 determining a temperature profile within said biological tissue.
- 1 45. The computer program of Claim 44, further comprising:  
2 showing temperature versus distance radially outward from said microwave  
3 antenna.
- 1 46. The computer program of Claim 44, further comprising:  
2 displaying temperature profile changes with time.

- 1 47. The computer program of Claim 44, further comprising:  
2 providing a characteristic of absorption material for absorbing said microwave  
3 energy in at least one direction.
- 1 48. A computer program for controlling a simulated microwave antenna for radiation  
2 of a biological tissue, comprising:  
3 providing at least one antenna characteristic for said simulated microwave  
4 antenna;  
5 providing at least one tissue characteristic into which microwave energy is  
6 deposited;  
7 providing at least one power level for operation of said simulated microwave  
8 antenna;  
9 providing at least one frequency of operation of said simulated microwave  
10 antenna; and  
11 providing a delivery time of operation of said simulated microwave antenna.
- 1 49. The computer program of Claim 48, further comprising:  
2 providing at least one cooling characteristic of cooling substances through which  
3 microwaves are transmitted.

1 50. The computer program of Claim 48, further comprising:  
2 providing a characteristic of absorption material for absorbing said microwave  
3 energy in at least one direction.

1 51. The computer program of Claim 48, further comprising:  
2 determining a temperature profile within said biological tissue.

1 52. The computer program of Claim 51, further comprising:  
2 showing temperature versus distance radially outward from said simulated  
3 microwave antenna.

1 53. The computer program of Claim 51, further comprising:  
2 displaying said temperature profile changes with time.

1 54. A computer program for a microwave antenna that radiates a biological tissue,  
2 comprising:  
3 providing a desired temperature profile within said biological tissue;  
4 providing at least one tissue characteristic into which microwave energy is  
5 deposited; and

6 providing at least one antenna characteristic.

1 55. The computer program of Claim 54, further comprising:  
2 providing at least one characteristic of a cooling substance through which  
3 microwaves are transmitted.

1 56. The computer program of Claim 55, further comprising:  
2 providing that said cooling substance is fusion material whereby cooling is  
3 produced by heat of fusion.

1 57. The computer program of Claim 54, further comprising:  
2 determining heating time.

1 58. The computer program of Claim 54, further comprising:  
2 determining frequency of operation.

59. The computer program of Claim 54, further comprising:  
determining a power level.